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Stoyo TODOROV[1]*, Yonko PASKALEV[2]

MODERN TRENDS AND INNOVATIONS IN THE MODERNIZATION OF RAILWAY LINES BASED ON EXPERIENCE IN THE REPUBLIC OF BULGARIA

Summary. The modernization of the Bulgarian railways has been underway for over 20 years. Hundreds of kilometres have been rehabilitated with funds from the European Union. The aim is to join the main Trans-European network, according to Regulation No. 1315/2013 [1] of the EU. Given the complex mountainous relief, the specific engineering objects are now the design and construction of a large number of tunnels (in the Sofia-Plovdiv section alone, over 16 tunnels are planned, the longest of which is 6 km long); the design and construction of railway bridges, some of which have unique dimensions; the rehabilitation of bridges; and the construction of drainage facilities, including drains, ditches, and culverts (some of the culverts have a unique length of about 80 m). The report analyses the main railway projects with a critical analysis of strengths and weaknesses, according to the EU cost-benefit analysis methodology. The analysis presented in this report is unique for Bulgarian railways, as it includes a large volume of projects in the field of designing and building railway infrastructure according to European and world rules, which have not been used in Bulgaria until now. This is only the first stage of scientific research, which involves collecting data, examining the data, and building a working hypothesis. After the completion of the construction (supposedly by around 2029), there will be measurements of the railway and a diagnosis of its condition. At this time, data will be collected again, and the credibility of the presented hypotheses will be verified. The conclusions will serve for the more adequate preparation of the technical assignments for future infrastructure projects in the field of railways.

1. INTRODUCTION

In 2024, 17 years had passed since Bulgaria joined the European Union. It is in its third program period. In the field of railways, pre-accession and cohesion programs have been operating for more than 20 years. Work is underway to prepare the connection of the Bulgarian railway network to the main Trans-European network according to the interoperability requirements of the infrastructure subsystem EU Regulation No. 1299 of 2014 [2]. The maximum running speed will be increased to 160-200 km/h for passenger trains and 120 km/h for heavy goods trains. This speed is achieved by changing the plan, removing the double thrust sections and removing the critical braking sections [3, 4]. For the new maximum running speed, a new contact network is being built and an automated train movement control system is being introduced.

In this regard, according to a certain schedule, the following steps are carried out: the modernization and reconstruction of priority sections of railway lines; the reconstruction of individual railway stations,

[1] University of Architecture, Civil Engineering and Geodesy (UACEG); Hristo Smirnenski Blvd. 1, 1164 Sofia, Bulgaria; e-mail: stoyo_fte@uacg.bg; orcid.org/0000-0002-5930-5242
[2] University of Architecture, Civil Engineering and Geodesy (UACEG); Hristo Smirnenski Blvd. 1, 1164 Sofia, Bulgaria; e-mail: y.paskalev@abv.bg; orcid.org/0009-0006-2631-0017
* Corresponding author. E-mail: stoyo_fte@uacg.bg

station buildings and station facilities; and the construction and reconstruction of traction substations. The specific railway sections are shown in Fig. 1.

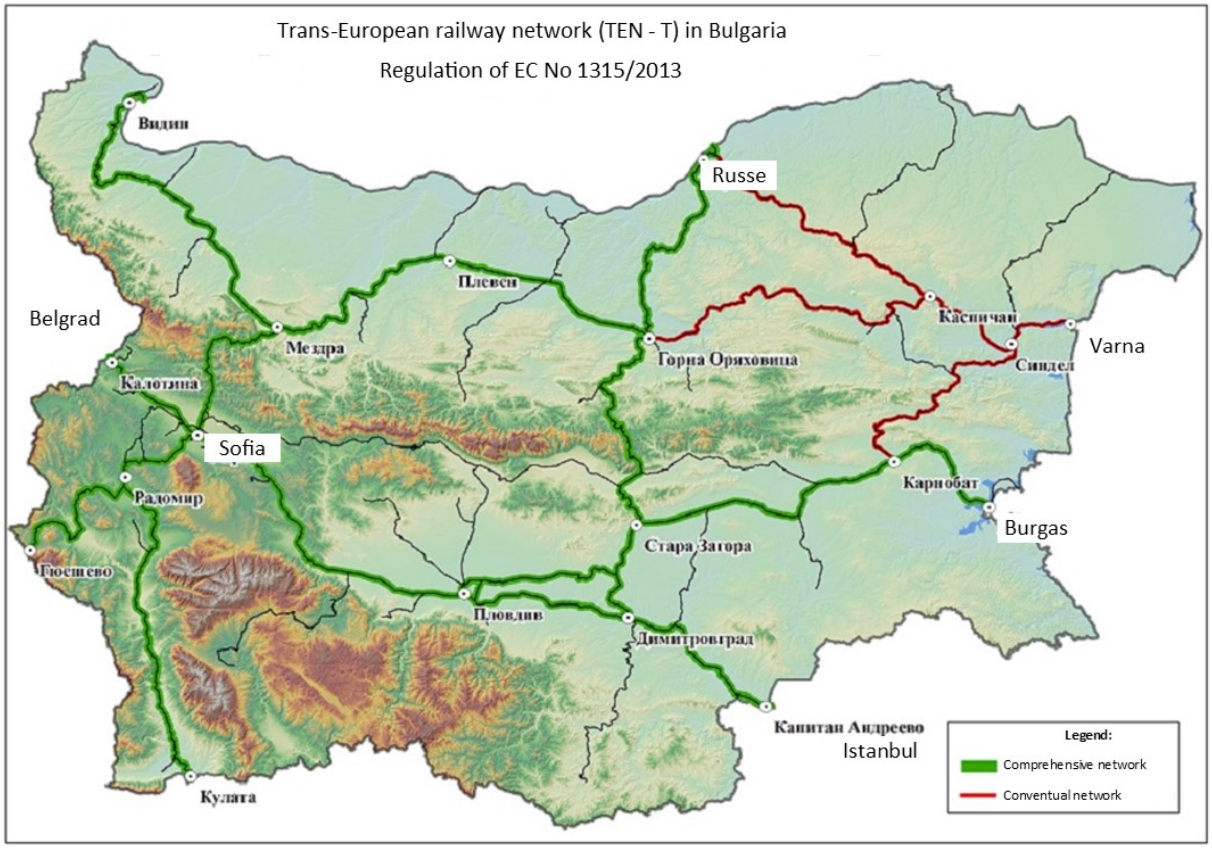

Fig. 1. Main sections included in the TEN-T network in Bulgaria [1]

2. PRIORITIES IN DEVELOPING THE BULGARIAN RAILWAY INFRASTRUCTURE

The main priorities for the Bulgarian railway network are adaptations to the new realities in the technique and technologies of the 21st century, the rehabilitation of individual sections with overdue repairs, and modernization according to the requirements for interoperability of the railway infrastructure subsystem Regulation No. 1299 of 2014 of the EU [2]. The latter means that trains pass smoothly through border crossings between individual countries in the European Union.

In order to be competitive with other modes of transport, international and domestic rail freight services (apart from passenger services), which have been liberalized since 1 January 2007, must be provided with a high-quality and sufficiently well-financed railway infrastructure, as this would enable freight services to be provided under good conditions in terms of commercial speed and travel time and which is reliable (i.e. the service it provides would be in line with the agreements reached with railway operators and climate change on a global scale) [5].

The use of the network can be optimized and its reliability can be ensured by introducing additional procedures to strengthen the cooperation between infrastructure managers in relation to the allocation of international train routes for passenger and freight trains.

The development of international rail corridors from a European railway network for competitive transport creates favourable conditions for the movement of freight trains and easy switching from a national network under improved conditions for the use of infrastructure, especially in a changed international situation and in line with climate changes risks [6].

2.1. Investment projects from the main and wide-ranging Trans-European transport network on the Balkan Peninsula

The modernization of the Bulgarian transport network is connected to the development of the Trans-European transport network (TEN-T), shown in Fig. 2, which provides a connection to ports and intermodal terminals.

Fig. 2. Comprehensive (railways and ports) and core (heavy railways, ports, and intermodal) network [1, 7]

2.2. Main objectives of the program for the development of the Bulgarian railway infrastructure in accordance with European requirements and standards

The main objective of the program in Bulgaria is a better-connected Europe by improving mobility and developing a climate change-resistant, smart, secure, stable, and intermodal TEN-T [1].

The goal is to create a greener, low-carbon, and sustainable Europe with a transition economy with zero net carbon emissions (Climate-Resilient Infrastructure: Adaptive Design and Risk Management [8]) by promoting a clean and fair energy transition, green and blue investments, circular economy, climate change mitigation and adaptation (as well as world experience, for example, the USA [9]), risk prevention and management [8] and sustainable urban mobility by promoting sustainable multimodal urban mobility as part of the transition to a net-zero carbon economy [1].

The priorities of the Transport Connectivity Program), as the program is called in Bulgaria, contribute to the objectives of the Green Deal as well as the Strategy for Sustainable and Intelligent Mobility of the EC [10].

The strategy envisages the transport sector to significantly reduce harmful emissions and become more sustainable. Green mobility will be the new growth method of the transport sector. Investments are planned in the field of ecologically clean types of transport powered by clean fuels, which improve the quality of railway infrastructure and reduce the non-ecological impact of transport on the environment (e.g. emitting harmful gases, polluting nature).

The main tasks set out in the strategy are completing the modernization of the TEN-T network on time and incorporating digital technologies [10]. For its implementation in Bulgaria, TCP investments are planned for the development of the TEN-T network in the territory of the country and the implementation and development of intelligent transport systems in all types of transport.

Transport connectivity also contributes to achieving the main goals of the Bulgarian transport network, defined in the Integrated Transport Strategy until 2030 [11]:

- Better efficiency and competitiveness of transport in the country's economy,
- Improved transport connectivity and accessibility,
- Reduction of unfavourable factors from the development of the transport industry in the Bulgarian economy.

Planned investments in the railway sector will attract passenger and freight traffic to rail transport by improving the quality of railway infrastructure. The development of the railway infrastructure along the TEN-T is essential for achieving the strategic goals of the EU Strategy for Sustainable and Intelligent Mobility, the national transport policy, and the implementation of the recommendations of the European Commission. With the planned investments, transport connectivity and accessibility will be improved, which will increase the efficiency of transport and promote the development of Bulgaria.

The planned investments will contribute to the achievement of a sustainable and developed transport system and define the initial conditions, including the development of the mobility of citizens and goods, which will advance domestic transport in individual countries, the competitiveness of the Common Market as a whole, territorial development, economic prosperity, social cohesion, and joint environmental protection.

Funds from the European Regional Development Fund, the European Transport Connectivity Fund, and national co-financing in the form of grants support the EU in achieving the “investment for growth and jobs in Member States and regions” objective. Approximately 40% of the funds are earmarked for investments in Northern Bulgaria, which is considered a backward region (Fig. 3).

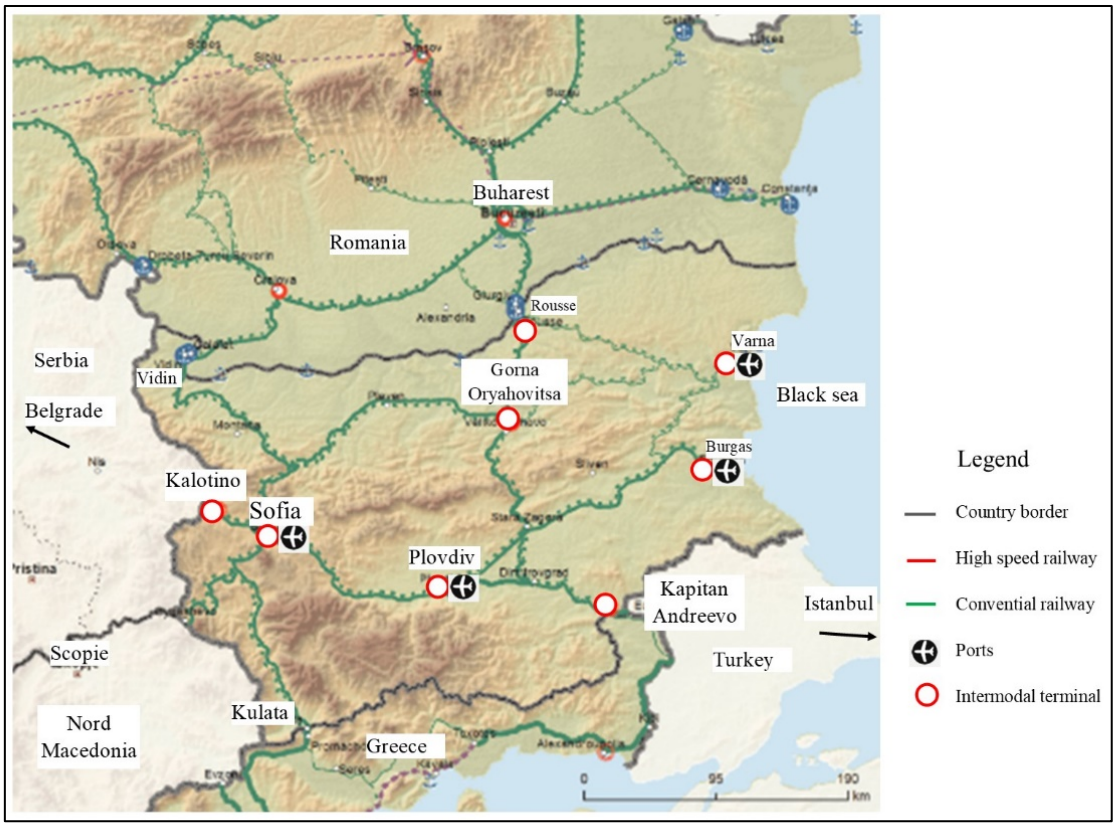

Fig. 3. Comprehensive (railways and airports) and core (passenger railways and airports) network [1]

Investments for rail infrastructure transport projects are mainly concentrated on the section of the Orient/Eastern Mediterranean transport corridor running horizontally through the middle of the country.

2.3. Main results to deadline 2029

The Bulgarian government has promised that by 2029 it will fulfil the following. Extension of the freight rail network 2 kilometres. All other projects are reconstruction or modernization of existing routes. With a total length of 140 km. The forecast for the traffic that will take place after the completion of the reconstructions and modernizations in 2029 is 4526 million tons per 1 kilometre in one year. The program period for investment projects in the EU is 7 years - from 2021 to 2027 inclusive. If a project is not implemented by 2027, its term is extended by a maximum of 2 more years - until 2029.

3. FUNDING ACTIVITIES AND PROJECTS

In Bulgaria, eligible activities must meet the following conditions:
- they must be in accordance with the provisions of Regulation (EU) 2021/1060;
- they must comply with the provisions of the national program ("Transport Connectivity" 2021–2027) to guarantee an effective contribution to the achievement of the goals;
- they must have been carried out by an eligible beneficiary and have been paid on time;
- they must be in accordance with the horizontal principles, according to Art. 9 of Regulation (EU) 2021/1060;
- they must comply with the requirements of the European and national legislation in the field of public procurement in compliance with the principles of transparency, proportionality, equal treatment, and non-discrimination with ensured competition on the broadest basis;
- they must fit within the available budget and have clear quantitative results;
- they must be in line with EU environmental policy, taking into account the UN Sustainable Development Goals, the Paris Agreement, and the conditions under Regulation (EU) 2020/852 related to respect for the principle of doing no significant harm so that they do not affect the achievement of an environmental and social objective.

The EU Cohesion Fund supports the following activities under Regulation 2021/1058:
1. investments in the field of natural environment protection, including funds for the sustainable development of the economy and green energy, which imply benefits for green nature, with particular emphasis on energy from renewable sources;
2. funds for the TEN-T transport network;
3. technical assistance for the preparation of tasks;
4. information sharing and research.

Eligible activities contributing to the achievement of the objectives of "Development of railway infrastructure along the ‘core’ and ‘comprehensive’ Trans-European transport network" are activities for the construction, modernization, rehabilitation, electrification and implementation of signalling and telecommunications on railway sections and measures for technical assistance for the preparation and completion of investment projects for the development of railway infrastructure under the TEN-T and the development of intermodal transport [7].

Several projects are being financed for the implementation of the activities in the period from 2021–2027, and the deadline for their implementation is 2029.

Modernization of the Sofia–Plovdiv railway line: Elin Pelin-Kostenets railway section, phase 2

The implementation (in whole or in part) of the following modernization activities of the railway section, divided into three lots with a total length of 51 km, is planned:
- earthworks: excavations and embankments, ditches and drainages, and superstructure, including stops,
- catenary: new and reconstruction for 160 km/h
- signalling and telecommunications;
- facilities: bridges and tunnels (Fig. 4);
- reclamation of the old route;

- environmental protection measures;
- information and publicity;
- testing and construction acceptance tests.

Fig. 4. One-way and two-way tunnels from the Sofia–Plovdiv line

In these sections alone, 16 one-way and two-way tunnels are planned, the longest of which is 6 km long. Phase 2 also includes all construction-related activities – construction supervision, author supervision, archaeological monitoring during construction, and technical assistance for project management (Fig. 5).

Fig. 5. Main basis, concrete junction, and formwork for open tunnel construction

An important point in the construction process is environmental protection. The railway line crosses two security zones. One is under the Natura 2000 program. This is an ecological program for the preservation of protected animal and plant species. The second security area is the drinking water catchment area in the mountain. It is divided into two parts. In the first zone, no human activity is allowed in order not to pollute the water. In the second zone, certain types of human activities are allowed, but only with the agreement of the basin management. Basin directorate is a state control body for the water of a certain river.

Modernization of the Sofia–Dragoman railway line – Serbian border: Voluyak–Dragoman railway section, phase 2.

This section is planned to be a 160 km/h renewed/modernized railway line with a length of 17,422 km. Three new railway bridges, a new road pedestrian underpass at km 21+672.74 and six new road overpasses/underpasses must be built on the new railway line.

The modernization of three tracks at the Petarch railway station is planned. Express trains without stopping and regional trains, which will stop, are planned at the stations. Transit trains will run at a speed of 160 km/h. For them, the catenary is special. On the tracks where the regional trains will stop, the catenary is of another type.

Reconstruction, repair or construction of a new building is planned for the various buildings. For the section Voluyak - Petarch, only Kostinbrod station is a new building. It is given in fig. 6.

Fig. 6. New railway station building at Kostinbrod station

Modernization of the Sofia–Pernik–Radomir railway line, Pernik–Radomir section

This project includes activities for the modernization of the railway section from the Pernik–Razdelietlna station to the Radomir station with a linear length of 17 km (Fig. 7).

Expropriation procedures, the technical design for the Batanovtsi bypass, and working drawings for the Batanovtsi bypass and the Pernik–Radomir railway section are foreseen.

The technical design includes:

- the design of a new ground bed, according to the technical requirements;
- reinforced and protected slopes of trenches and embankments;
- works on the railway and catenary system on the Pernik–Radomir section;

- new artificial works (drainage; railway facilities, including tunnels and bridges; underpasses and overpasses; new catenary and power supply; security equipment and telecommunications; noise protection facilities; and an acoustic wall).

Fig. 7. Sofia–Pernik–Radomir is part of the Orient/East Mediterranean Corridor of the Core Network Corridors of the EU

Railway station facilities are being modernized and built, and crossings with technical infrastructure in the stations are being reconstructed.

This project finances technical assistance for the development of a design task and a design for the construction of the Sofia–Pernik–Radomir–Gueshevo railway line and the border with the Republic of North Macedonia, which is part of the Orient/East Mediterranean Corridor of the corridors of the main network. The total funding for the technical project is BGN 31 million.

Construction of a railway connection between Bulgaria and North Macedonia

This project is common to both countries and is in the interest of the EU in accordance with Article 4 of Regulation 1315/2013. It includes:

- construction of the railway infrastructure from km 76+400 to the border with North Macedonia (Fig. 8);
- construction of the Deve Bair railway tunnel in Bulgaria;
- installation of the SCADA train control system;
- modernization of security equipment and telecommunication systems in stations through the implementation of ERTMS;
- installation of fire alarms and video surveillance systems in tunnels controlled by the Central Dispatch Center in Sofia.

Fig. 8. The first project for the construction of the Sofia–Kyustendil–Gueshevo railway line was accepted in 1865

Completion of the facilities on the Karnobat–Sindel railway line

This project is historic for Bulgaria. It was started 40 years ago as a doubling of the section (Fig. 9), but it has been delayed. It has been stopped twice with all possible complications, including the collapse of tunnel lining and adjacent infrastructure retaining walls and trench slopes.

The two-way tunnel was designed 40 years ago according to the current cross-section, but the requirements for the cross-section have changed.

The planned activities include the completion of the facilities on the Karnobat–Sindel railway line in the implementation of ERTMS.

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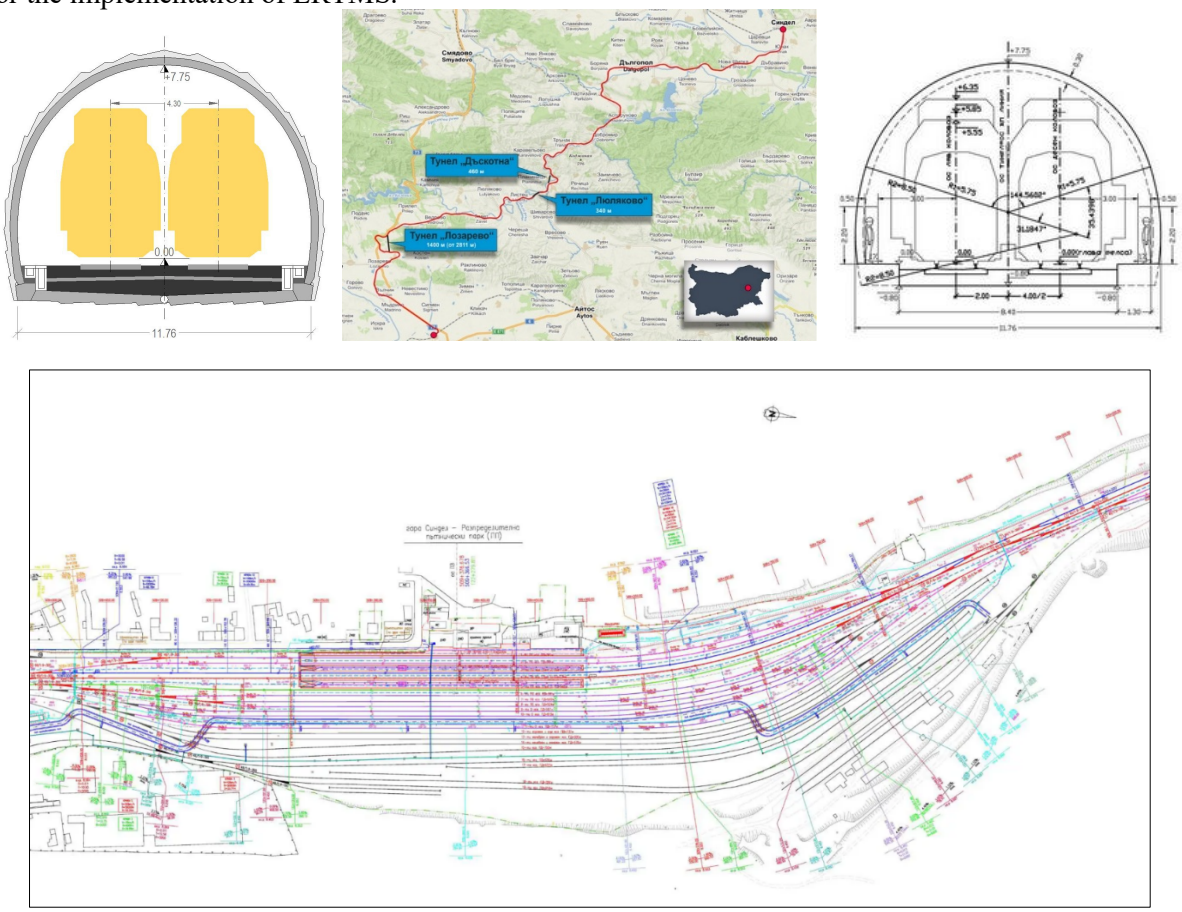

Fig. 9. Situation of the Karnobat–Sindel railway section and the Sindel station (cross-section of the two-way tunnel)

Modernization of the Sofia–Pernik–Radomir railway line, Sofia–Pernik section

This project includes the development of a technical project and the construction of a railway track, according to technical requirements, as well as reinforced and protected slopes for trenches and embankments.

The following elements must be constructed:

- new drainage and railway facilities, including tunnels and bridges;
- underpasses and overpasses to the road crossing;
- a new catenary and power supply;
- security equipment and telecommunications;
- noise protection facilities and reconstructed intersections with technical infrastructure.

This project is in the technical assistance phase for the preparation of a design task and technical design This means that the terrain is taken by maps (Fig. 10). Data for trace is collected by old projects. Ways to finance the project are loans from banks or European programs like "connected Europe". A design assignment and documents for an open public procurement for the design and construction of the site are being prepared.

The project is complex because it is being developed in a highly urbanized area. This necessitates the development of many variants (shown in Fig. 10). Often, public protests follow the announcement of options, and the design starts all over again.

Implementation of ERTMS Level 2 on railway lines other than those mentioned above

The project is for the implementation of a new train management system - European Rail Traffic Management System (ERTMS). Depending on the method of data transmission, it has a different level. In this case, level 2. Which means transmitting a signal, as in GSM-R mobile phones. The project includes dispatch centralization, track-mounted equipment and software. The trains are monitored with cameras and sensors in the tracks. Passenger information includes: loudspeakers and electronic boards. New is the video surveillance of crossings and other dangerous sections.

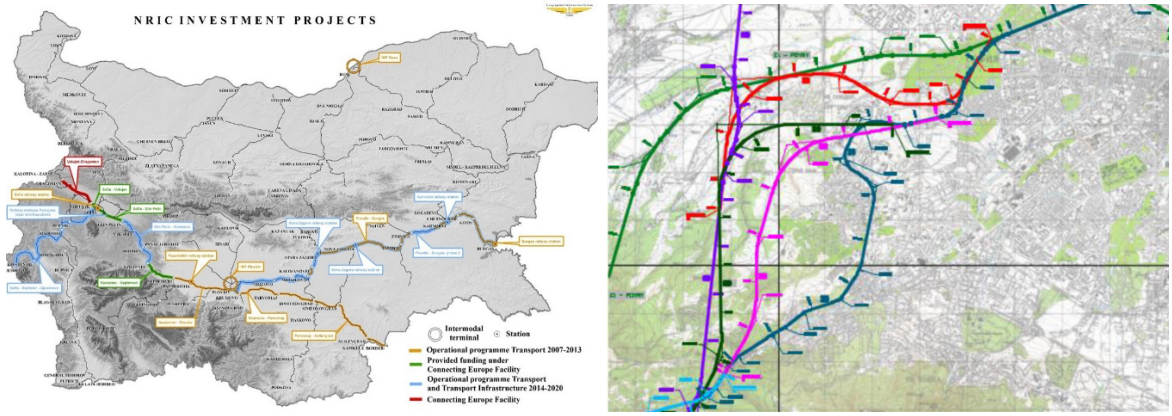

Fig. 10. Investment projects and options for leaving Sofia on the railway line Sofia-Pernik-Radomir

The projects include various climate adaptation measures (the construction of drainage and sewerage systems, strengthening of the substructure, and construction of fortifications) to ensure the resilience of the railway infrastructure and its adaptation to climate change.

The separation of ERTMS construction projects from the railway track modernization project may be a drawback. In the latter project, elements of the signalling and telecommunication infrastructure (e.g. pipes and distribution boxes) are being built; in the ERTMS project, cables (optical lines and modern telecommunication channels) are being designed. They are divided into tasks, (e.g. companies, contractors, and control bodies). The agreement is available in the draft phase. But the construction of individual sections is progressing differently. This leads to problems when laying the cables in the finished channels and inspection shafts. Most often, they are filled with construction waste.

4. RISK ANALYSIS

Project risk assessment for railway projects is done with a cost-benefit analysis [12, 13]. The total amount foreseen for the implementation of the projects listed above is of the order of 1 billion euros, or 2 billion BGN. This is a very large amount for the budget of the Bulgarian state and, therefore, must be planned and managed very carefully. In addition to financial risk [8], the development of projects must account for the consequences of climate change [5]. The increase in average temperatures leads to a change in the overall parameters and support of the bridges and culverts, as well as the dimensioning of the tracks in the presence of a jointless track and other facilities in the railway stations. Climatic changes also lead to changes in the amount of precipitation and water runoff. At first glance, a drought is expected, but in practice, the intensity of rainfall is increasing. The maximum amount of water must pass through ditches, culverts and bridges. Alternatively, it can be evaluated with a cost-benefit analysis [14]. The cost-benefit analysis is used not only in the European Union but also in Great Britain [14] and all over the world, including in the USA, Korea [15], and China [16].

It is necessary to consider the strengths and weaknesses of projects. Risk assessment should be conducted in general and for each project separately. Every construction project is risky. Objective reasons for delaying the project may appear. For example, the embankment or excavation in a given

section has gone beyond the designated areas for construction. This means expropriation of property, appeal, court decision, etc. A second example was when the excavation yielded soil that could not be worked with the chosen mechanization. This leads to redesigning the project, choosing a new technology and delaying the work.

An example can be found in Table 1, compiled for the purpose of the report.

Table 1

Assessment of critical factors

Activity	Advantages	Disadvantages
Modernization of the Sofia–Plovdiv railway line: Elin Pelin–Kostenets railway section, phase 2.	A huge project of great international and national importance. In the first phase, more than 16 tunnels and numerous large bridges are planned. The longest tunnel is over 6 km long.	Difficult terrain, protected areas under Nature 2000, railway line crossed two catchment basins for drinking water in the second sanitary protected zone.
Modernization of the Sofia–Dragoman–Serbian border railway line: Voluyak–Dragoman railway section, phase 2	A huge project of great international and national importance. It will improve the situation at the border because some of those crossing will use rail transport.	It is being built parallel to the Europa highway. Access to an important border crossing is becoming difficult.
Modernization of the Sofia–Pernik–Radomir railway line, Pernik–Radomir section	A section that is an alternative to the Struma highway. It crosses a large number of Nature 2000 protected areas.	Many facilities are being built to preserve fauna and biodiversity (e.g. bridges for bears to cross, dry paths in the culverts for small animals to cross).
Construction of a railway connection between Bulgaria and North Macedonia	An important international project from corridor number 8. So far, there is no rail connection between the two countries. The first project dates back to 1865, but real construction only took place in 1906 and during the Second World War.	Problems of a political and economic nature because North Macedonia is not a member of the EU.
Completion of facilities on the Karnobat–Sindel railway line	A backward project with a 40-year history. The first two-way tunnel in Bulgaria, which has undergone multiple construction renewals, collapsed. It is currently stopped.	Delayed section doubling project with partial tunnel demolition, conservation, and retrofitting.
Modernization of the Sofia–Pernik–Radomir railway line, Sofia–Pernik section	A section that is an alternative to the Struma highway. In a separate project for greater flexibility.	Construction permits, financing, and public procurement are problems.
Implementation of ERTMS Level 2 on railway lines other than those mentioned above	In Bulgaria, it is designated as a separate project with built road infrastructure. The infrastructure channels, distribution boxes, etc., are being built by the railway builders and the cables are in the ERMS project.	There are often reconciliation conflicts with projects completed in previous phases. Some of them diverged in time up to more than five years, which means projects are accepted and completed for the pipes, and then stopped.

All planned projects under the PTS correspond to the principle "of not causing significant damage" in the sense of Art. 17 of Regulation (EU) 2020/852. The types of actions have been assessed as

compatible according to the technical guidelines of the Recovery and Resilience Mechanism /RRF DNSH/.

For each project, the specific beneficiary National Railway Infrastructure Company (NRIC) submits an application form, with applicable documents attached to it, including implementation risks. Some of the main risks are timely and necessary financing; finding a loan for revolving credit; inflation, which in five to seven years can significantly increase the cost of projects; and the price of construction materials.

Another risk is failure to meet the deadline of 12/31/2029. The third program period for Bulgaria of the European programs ends in 2027, but in practice, two more years are given to complete the projects.

The second necessary Table 2 outlines the positives and negatives of rail transport in the overall transport structure.

Table 2

Assessment of the positive and negative factors of railway transport

Positives	Negatives
Low environmental footprint: Compared to other forms of transport, railways generally have a lower environmental impact as they require less land and infrastructure.	Dependence on weather conditions: Railways can be affected by adverse weather conditions, such as floods caused by climate change.
Accessibility: Tourist railways (funiculars) can provide access to remote or hard-to-reach places, such as mountainous areas or tourist attractions, where traditional forms of transport cannot reach, and if they can, they are not as efficient.	Trains run on a schedule, which reduces travel flexibility. Narrow-gauge railways or alternative funiculars are used.
Reduction of congestion and accidents: The use of rail transport significantly helps to reduce congestion and the risks of traffic accidents on roads that are in a very unfavourable condition during the winter season or heavy loads during the holiday season. The development of public transport is supported.	High initial costs: Building and operating railroads is an expensive endeavour, but so are alternative highways.
Capacity: Due to its independent route and the possibility to increase the number of wagons, the capacity is practically unlimited, unlike the personal motor vehicle.	Limited flexibility: Rail routes are fixed and cannot be easily changed or expanded, which can limit their ability to adapt to changing transport needs, especially those of the individual.
Scenic views: Railways often provide passengers with great panoramic views of the surrounding landscape, which adds to the overall tourist travel experience.	Dependence on electricity: Railways are highly dependent on electricity, making it mandatory to have or build electricity infrastructure in the area from several independent sources.

Another key point is the acceptance of construction. It happens in a loaded and unloaded state. The measurement of the quality of the geometry in Bulgaria takes place according to BDS EN 13848 [17].

However, there are alternative methods for diagnosing the quality of the railway track. For example, the general condition of a railway track can be checked with the Track Quality Index (TQI), which is a numerical value that represents the relative condition of the geometric characteristics of the track [18]. According to the American Railway Engineering and Maintenance of Way Association (AREMA), TQI is a number derived from a formula characterizing the collected information (measured characteristics) from a gauging car on a certain section of railway. The Federal Railroad Administration (FRA) of the USA calculates the TQI for gauge, level, cant, and flush. Indian Railways has developed a formula to represent railway quality called the TGI. It is based on the standard deviation of the various geometric parameters for a 200-m road section. The TGI is calculated for each segment and the average value per kilometre gives the total TGI. The TQI is the index used in China. It is the sum of the standard deviations

of seven faults. They are grade faults (for left and right tracks), axle faults (for left and right tracks), gauge, cant faults, and sweep, measured for every 200 m of railway track.

The EM-120 "Plasser & Theurer" self-propelled railway measuring gauge, available from the national operator of Bulgaria, gives the so-called ball assessment of the railway. The analysis system is based on the calculation of the change of acceleration of a short vehicle moving on a road taken as a theoretical model. The differences between the measured flashes between two consecutive points (x-1 and x) in the horizontal and vertical planes for each meter of the measured section are used to determine the change in acceleration. The measurements made of the flush in the horizontal plane with a chord of 10 m are used, and for the vertical plane, the measurements of the longitudinal profile with a chord of 11.80 m are used.

5. CONCLUSIONS

The current review, in-depth analysis, and comparison of the projects led to the following conclusions.

The article notes a list of selected ongoing and completed projects that are currently at various stages of implementation. Each investment project has a duration of five to seven years, and sometimes more. Most projects are in the design stage (conceptual, technical or working design). Designers envisage the implementation of the project under certain conditions and the achievement of certain results. The construction is planned to be completed in 2029. It is planned to measure the parameters of the railway. It can be done with the available rail measuring machine EM-120 "Plasser & Theurer", including the methodology used in the USA [19], For example: the conditions (comfort) of travel, the conditions for the drainage of surface and underground water, noise pollution along the line, etc. These will be compared with the designer's predictions and analysed. The idea is to collect a large enough database to compile adequate terms of reference for future projects.

The risks facing the projects are financing, lending from banks, and international risks, which are felt in Bulgaria as inflation. All the mentioned projects are partially or fully financed by the various programs of the European Union (e.g. Connected Europe, Transport Connectivity, and Development of the Regions). For all of them, construction began with a certain minimum advance. After the completion of certain construction and assembly works and acceptance of the works by an independent commission, the specified sums are paid, which means the builder needs to have money available for operating expenses. These are secured by a bank loan and pledging certain property or funds. There is a risk of insufficient financing, lending by banks, and possible international risks (e.g. the war in Ukraine).

The planned investments in the railway infrastructure of Bulgaria contribute to achieving a sustainable and developed transport system. The problem is that there are regional risks and possible project failure. That is why many sites are planned all over the country. This reduces the risk of regional problems but divides railway sections into parts. Currently, there is no fully modernized border-to-border railway line.

The necessary prerequisites are being created for improving the mobility of people and goods, which will promote the development of the internal market and EU competitiveness, territorial, economic and social cohesion and environmental protection.

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